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Notes on Apple and Potato Diseases

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Leaf Spot of Apple

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AGRICULTURAL EXPERIMENT STATION

DURHAM

FIG. 35.—Spores of Late Potato Blight. Magnified.

FIG. 36.—Spraying Potatoes.

Notes on Apple and Potato Diseases in 1898

BY H. H. LAMSON

The principal fungous diseases of the potato are the *scab*, the *early blight*, and the *late blight*. Each of these is due to a minute parasitic plant which finds in the potato a congenial host plant, and develops on it to its serious damage. The *scab* attacks the tubers, the *early blight* the leaves, and the *late blight* all parts of the plant producing in the tubers the disease known as *potato rot*. Each of these diseases is propagated by means of spores or germs which bear the same relation to the fungous plant that seeds do to the higher plants.

POTATO SCAB

This disease affects the surface of the tubers, producing the familiar scabby or scurfy appearance. The crop is infected either by germs on the seed planted or by germs already present in the soil derived from a previous crop. These facts lead to the following practical suggestions as to treatment of the disease: Plant seed known to be free from scab or seed which has been freed from living germs by some method of disinfection; do not plant on ground from which a scabby crop has previously been taken.

Since under ordinary circumstances it is difficult to obtain seed entirely free from scab germs, some method of disinfection becomes an important consideration. Three substances in particular have been recommended for this purpose, corrosive sublimate, formaline, and sulphur.

Corrosive Sublimate.—In previous bulletins of this Station experiments have been described in which this substance was used with profitable results. The following additional experi-

ments are here reported. In these experiments the potatoes were planted on ground which had probably not been used for this crop for many years at least. The seed potatoes selected were badly scabbed. Part of the seed was planted untreated; the other part was treated with corrosive sublimate in the manner to be described later. Treated and untreated seed was planted in plots side by side, under similar conditions of soil and fertilzation. When the potatoes were harvested the untreated plots in field A, gave 48 per cent. scabby, and 52 per cent. free from scab; the treated plots gave 17 per cent. scabby, and 83 per cent. free from scab; a gain of 31 per cent. in favor of the treatment.

A similar experiment in another field (field B) gave from untreated seed 35 per cent. scabby and 65 per cent. free; from treated seed, 13 per cent. scabby and 87 per cent. free, or a gain of 22 per cent. in favor of the treatment.

Method of Using Corrosive Sublimate.—Dissolve corrosive sublimate in water at the rate of one ounce to eight gallons of water. Keep this solution in a wooden vessel; a barrel, half barrel, or washtub will answer the purpose. Put the potatoes to be treated in a coarse sacking bag, and plunge in the solution; let them remain for an hour and a half, moving them about occasionally to insure thorough wetting; then dry the potatoes, and they are ready for planting. Care should be taken that they do not become contaminated again by dirt from untreated potatoes. It should be remembered that corrosive sublimate is a violent poison if taken internally, therefore care should be taken in using it.

Formaline.—This is a liquid which has recently come into prominence as a valuable disinfectant. It is sold under various names, "Formalin," "Formine," "Formalose," "Formaldehyde," and is usually a 40 per cent. solution of formaldehyde gas in water.

In our experiments with this substance as a remedy for potato scab two strengths were used, viz.: One pint to 32 gallons of water, and one pint to 21 gallons of water. The potatoes were soaked in these solutions for two hours. They were planted alongside the corrosive sublimate plots in field A, and under the same conditions, the same untreated plots serving as checks

for both. As above, the untreated plots gave 48 per cent. of scabby potatoes and 52 per cent. scab-free. The plots treated with the stronger solution of formaline gave 13 per cent. scabby and 87 per cent. scab-free; a gain of 35 per cent. in favor of the treatment. The plots treated with the weaker solution gave scabby, 21 per cent., scab-free, 79 per cent.; a gain of 27 per cent. in favor of the treatment. These results indicate that formaline is an effective remedy for the scab, and in the strengths used above rivaling corrosive sublimate. It possesses advantages over corrosive sublimate in being less poisonous and more easily applied, but with the data at hand we are not yet ready to recommend its substitution for that remedy.

Influence of Different Fertilizers on Development of Scab.—The following table summarizes the results of experiments in regard to this point. The experiments with different fertilizers were crossed with those on the treatment of the scab on the same plots.

		Field A.		Field B.		Previously reported.	
		Treated.	Untreated.	Treated.	Untreated.	Treated.	Untreated.
		Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.
Phosphate	Scab free	83	53	79	89	92	63
	Scabby	17	47	21	11	8	37
Stable manure	Scab free			80	60	97	86
	Scabby			20	40	3	14
Plaster	Scab free					88	44
	Scabby					12	56
Air slaked lime	Scab free	89	47	100	58		
	Scabby	11	53	0	42		
Wood ashes	Scab free	70	34	95	28	90	59
	Scabby	30	66	5	72	10	41
No fertilizer	Scab free	90	73	95	81		
	Scabby	10	27	5	19		

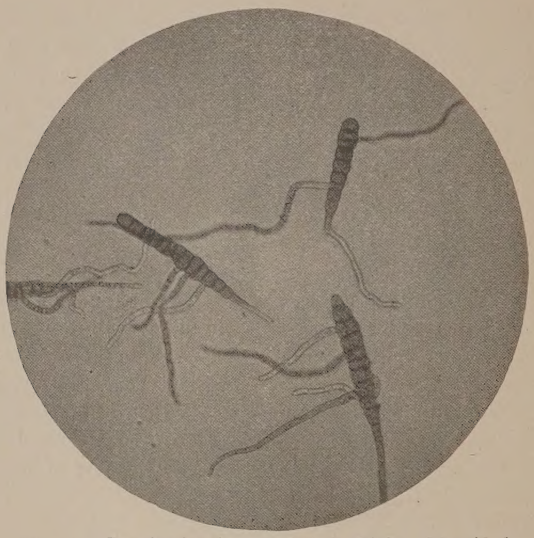

FIG. 37.—Germinating Spores of Early Blight. Magnified.

From these not wholly concordant results we prefer rather to point out indications than to draw final conclusions.

The indications are that, first, all of the fertilizers named may favor the development of the scab to a greater or less degree; hence as fertilizers cannot be dispensed with, the greater advisability of treating the seed. Second, air-slaked lime, plaster, and ashes are especially likely to increase the amount of scab.

POTATO BLIGHTS OR "RUSTS"

As indicated above there are two forms of "*blight*" or "*rust*," the *early* and the *late*. There is usually little difficulty in distinguishing between the two. The *early blight* appears in June or July, the *late* in August. The *early blight* presents numerous sharply-outlined, dark brown spots on the leaves; the *late* blight manifests itself as a progressive withering or dying of the leaves, spreads more rapidly than the *early*, and usually presents a readily seen white mold-like growth on the under side of the leaves. Both diseases often appear together, especially on late varieties. Both of these diseases are spread

by spores. Fig. 37 shows the curiously shaped spores of the *early blight* germinating preparatory to infecting the host plant. Fig. 35 shows the egg-shaped spores of the *late blight*.

Repeated experiments have shown that both these diseases may be profitably controlled by spraying with the Bordeaux mixture.

When to Spray.—For *early blight* on early potatoes, spray when the vines are about two thirds grown or as soon as the disease makes its appearance; repeat the spraying in about two weeks.

For both *early* and *late blight* on late potatoes spray three times; the middle of July, the first of August, and the middle of August.

Rainy weather may render it advisable to spray at shorter intervals and to increase the number of sprayings.

Spraying Outfit.—Fig. 36 shows a convenient outfit for potatoes or fruit trees; a pump specially designed for spraying mounted on a barrel of about 50 gallons capacity drawn on a wagon with one man to pump and another to apply the spray. In spraying potatoes a liberal length of hose should be used; we use fifty feet or more. A farmer naturally hesitates to drive over a field of thrifty "tops," but the injury is hardly to be considered as against the benefit of spraying. With a good length of hose the necessity of driving over the field is reduced to a minimum.

Effect of Bordeaux Mixture on Insect Injuries.—In this regard the following is of interest. A field was sprayed three times with Bordeaux mixture, a strip across the rows on one side was left unsprayed as a check. Between the first and second sprayings the unsprayed vines died. No fungous trouble could be detected, nor were the "slugs" of the Colorado beetle present, although many of the mature beetles were. The *flea beetle*, however, was present and was probably the chief cause of the destruction of the vines. The sprayed vines lived. A strip of the sprayed potatoes of the same area as the unsprayed and lying next to it yielded a little more than three times as many marketable potatoes. Bordeaux mixture is probably one of the best remedies against the flea beetle. (See Bulletin 29 of this Station.)

APPLE DISEASES

Spraying experiments on apples during the season of 1898 were not made with reference to any particular disease, but against any disease that might make its appearance. The trees sprayed were mostly Baldwins. The diseases which developed were those shown in Fig. 38, characterized by small brown

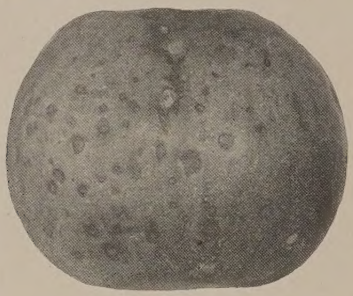

FIG. 38.—Brown Spot of Baldwin.

spots on the surface of the fruit; in Fig. 39, characterized by black or sooty diffuse blotches of no appreciable thickness, also on the fruit; and in figure on title page, characterized by small, round, reddish-brown spots on the leaves. The latter disease, which is caused partly at least by *Phyllosticta pirini*, in some cases does quite serious damage. The two other diseases seem to injure the fruit chiefly by rendering it unsightly.

The trees were sprayed three times with 1 to 10 Bordeaux mixture once before blossoming, again just after the fall of the petals, and a third time about two weeks later. Paris green was added to the mixture at the second spraying for the codling moth.

The following table shows the results:

		Nearly or quite free from spots.	Spotted.	Badly spotted.
Brown spot on Baldwin,	Unsprayed,	48 per cent.	44 per cent.	8 per cent.
	Sprayed,	78 "	18 "	4 "
Sooty spot on Baldwin,	Unsprayed,	17 "	63 "	20 "
	Sprayed,	83 "	14 "	3 "
Sooty spot on Greening,	Unsprayed,	18 "	57 "	25 "
	Sprayed,	77 "	23 "	0 "

The Greening seems to be free from the brown spot but is very apt to be disfigured by the sooty spot.

Brown Spot of the Foliage.—In all of our spraying experiments during the past four or five years, the Bordeaux mixture has appeared to have but little if any effect upon this disease.

Apple Scab.—This disease has done but little damage to Baldwins in this part of the state at least for three or four years.

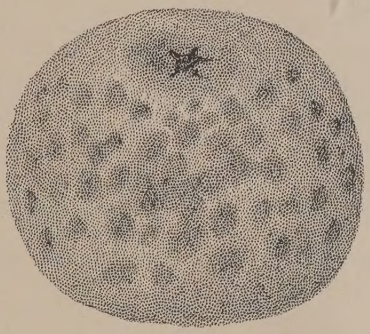

FIG. 39.—Sooty Spot of Apple.

When it does make its appearance on this or other varieties it readily yields to Bordeaux mixture. The same is true of the *scab* and *cracking* of pears.

When to Spray for the Fungous Diseases of the Apple and Pear.—Spray once before the blossoms open, again as soon as the petals fall, and a third time two weeks later. As in case of potato diseases the number of sprayings may have to be increased in rainy weather.

BORDEAUX MIXTURE

The Bordeaux mixture continues to recommend itself as the best all-round remedy for fungous diseases. It is efficient, it is cheap, and it is easily prepared when one once gets the "hang" of it and is willing to take pains. Directions should be carefully followed by those who are unfamiliar with its preparation.

The ingredients of the Bordeaux mixture are blue vitriol, lime, and water. The ingredient which kills the fungus is the

blue vitriol. The purpose of the lime is to prevent the injury to the foliage which a simple solution of blue vitriol would cause.

The proportion of the ingredients may be varied considerably. The formula which was recommended in Bulletin 27 of this Station still seems to us a satisfactory one, namely:

Blue vitriol	1 lb.
Lime, fresh	⅔ "
Water	10 gals.

As the quantity most frequently prepared would be a barrel the formula may be given as follows:

Blue vitriol	5 lbs.
Lime	3⅓ lbs.
Water	1 bbl. (45 to 50 gals.)

For the details of preparation see Bulletin No 45 of this Station.